COMPREHENSIVE SITE ASSESSMENT

CEDAR CHEMICAL CORPORATION PLANT SITE

ARKANSAS HIGHWAY 242
WEST HELENA, ARKANSAS

ARD 990660649

Prepared for:

ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY

BROWNFIELD PROGRAM

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Executive Summary

Extensive investigations have been conducted at Cedar Chemical Corporation (CCC) facility in West Helena, AR, prior to bankruptcy. The investigation data has been evaluated through a risk assessment process. Potential owner/operators have inquired with ADEQ to reuse the site for various manufacturing process utilizing the existing facilities. ADEQ prepared this Comprehensive Site Assessment (CSA) for disclosure of known environmental site conditions to potential operators. This CSA also provides an overview of the general plant operational conditions as they may relate to environmental issues associated with future operations.

Apparent Risks Associated with New Operations

The 1999 Risk Assessment quantitatively evaluated the inhalation of volatiles and dust, incidental ingestion, and dermal contact with surface/subsurface soil, and incidental ingestion and dermal contact with perched groundwater exposure pathways for a future onsite construction worker population. A substantially high risk to future construction workers was indicated at Sites 1,2,3,4, and 9. Site 5 should also be considered a substantial risk if the building was to be removed or replaced.

The 1999 Risk Assessment quantitatively evaluated inhalation of volatiles and dust, incidental ingestion and dermal contact with surface soils exposure pathways for current/future onsite worker populations. A substantially high risk to onsite workers was indicated at Site 9. Onsite workers historically rarely worked in this area, but did work inside buildings located on this disposal site. Indoor air pathways were not evaluated in the risk assessment.

Site 5 Drum Vault has many uncertainties remaining after the investigations and risk assessment was complete. The contents of the drums are unknown and therefore there is no certainty in what the associated risks may be as they relate to onsite workers.

Associated risks could be managed during construction activities using personal protective equipment and best management practices. A soil management plan for construction activities should be developed for all construction activities by any new owner/operator. Institutional controls could be implemented to minimize risk through restricted access.

Future Release Potential from New Operations

ADEQ personnel have observed the plant during site visits since abandonment. These observations are relevant to any future operations where future releases are of concern.

Waste Water Treatment Plant

The associated ponds were originally constructed in 1977 with a clay-like additive mixed with native soil and compacted to form liners for the ponds. Sludges were not removed from the ponds. In the event that sludge is removed from the ponds, it is likely that the liners may be damaged. It is also likely that clay materials may break down or become more permeable upon sustained contact with certain organic and chlorinated organic compounds. Groundwater mounding has been reported around the WWTP and contaminants have been reported in groundwater samples. The WWTP may actively leak into the groundwater. Future operators should at a minimum monitor groundwater around the WWTP to show that new operations are not causing further groundwater degradation or consider retrofitting the ponds with synthetic liners and leak detection capabilities.

Tank Secondary Containment Areas

ADEQ personnel observed the tank containment areas during precipitation events since abandonment. Several containment areas were observed not to accumulate precipitation or had active leakage observed. Containment areas that fail to hold stormwater will not contain a spill event. The investigations conducted indicated significant contamination at Site 4. Future operators should repair or reconstruct tank secondary containment areas that are not capable of containing a spill to minimize the potential of further degradation.

Process Containment Areas

Each of the process units has curbing around the concrete pads and sumps that are designed to contain releases. Curbing has been observed actively leaking during precipitation events and would perform similarly during a release event. Process sumps are used to collect released materials where they are pumped to the WWTP. Process sumps are typically made from concrete that tends to crack and form a release pathway into soils and/or groundwater. Both soil and groundwater around the process units were determined to be contaminated in facility investigations. Future operations should consider improvement to containment areas and process sumps to minimize the potential for further degradation.

Underground Piping

Underground piping was determined to be a major source of contamination in the facility investigations. Most of the underground piping was replaced by CCC, with the exception of wastewater piping beneath Industrial Park Drive to the WWTP. It is unknown if this underground piping has leak detection capabilities. Future operations should consider the elimination of underground wastewater piping to minimize the potential for further degradation.

Continuing Release Potential from Previous Operations

The majority of the sites identified in the facility investigations should be considered continuing sources of contamination to stormwater and groundwater, due to the fact remediation or stabilization were not completed by CCC before bankruptcy.

Stormwater sampling (conducted by ADEQ) shows contamination results during each precipitation runoff event. New operators will be responsible for managing stormwater in future NPDES permitting scenarios. Stormwater management may also play a significant role in controlling continuing releases to groundwater. Excessive stormwater retention at the site likely mobilizes contaminants from soils into an aqueous phase that either runs off or permeates the ground eventually entering the alluvial aquifer. Future stormwater management should minimize stormwater retention to minimize the potential for further degradation.

Risk Potential of Offsite Groundwater

The 1999 *Risk Assessment* quantitatively evaluated agricultural workers inhalation of volatile organic compounds released from the alluvial aquifer during irrigation. A substantially high risk to agricultural workers was indicated, based upon maximum detections. The 2001 *Risk Assessment Addendum* quantitatively evaluated agricultural workers inhalation of volatile organic compounds released from the alluvial aquifer during irrigation to, using actual data obtained from impacted irrigation wells. An acceptable risk to agricultural workers was indicated, but remains uncertain for future groundwater plume movement.

Potential Risk To Indoor Air Through Vapor Intrusion Into Buildings

The indoor air pathway was not evaluated in the 1999 *Risk Assessment* or the 2001 *Risk Assessment Addendum.* Based on the presence of volatile constituents of concern detected in the shallow soils and groundwater in and around the building(s) and dependent upon the proposed use of the building(s), it is recommended any proposals for reuse/redevelopment evaluate the potential risk to indoor air through vapor intrusion. ADEQ has access to shallow soil and groundwater data from the site which could be used to evaluate the potential for vapor intrusion concerns.

Conclusions

Potential risks associated with the site are considered manageable from the perspective of onsite workers and future construction workers scenarios. The site is suitable for continued use in an industrial setting.

The results of historical operations are likely to further contribute to stormwater and groundwater contamination, until the site is stabilized, remediated, or contaminants are eventually diluted.

Potential risks to offsite agricultural workers depend on the irrigation practices and movement of the contaminant plume. Such risk could be managed if water use could be controlled, the plume remained stable, or if active remediation of groundwater was used to cut off uncontrolled contaminant migration.

Potential risks from exposure to indoor through vapor intrusion into buildings are unknown.

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1.0 Introduction

ADEQ assumed control of the site on October 18, 2002, when abandonment was authorized by a bankruptcy court in the State of New York. ADEQ issued Emergency Order of the Director LIS 02-148 to address the emergency situation. The agency is providing security, until certain activities are completed, and will provide stormwater operations and maintenance indefinitely through funding provided from the Remedial Action Trust Fund. The site has been listed as a State priority site.

ADEQ is the lead agency for the site. ADEQ is working closely with other agencies, such as the Arkansas Department of Economic Development to redevelop the property into uses that are beneficial to the surrounding community. The Brownfield program provides a mechanism to limit the liability of a new owner/operator for the redevelopment of previously contaminated property that was caused by previous owner/operators. The Hazardous Waste Division of ADEQ is leading site stabilization and redevelopment efforts.

The objectives of this project are to provide disclosure of all investigations related to environmental contamination conducted at the site to potential purchasers of the site. This report also provides information on the current status of the plant that will assist potential operators in addressing environmental issues that relate to the Brownfield program.

2.0 Intended Land Use

The site is intended to remain industrial use when redeveloped. The site may not be suitable for residential development or other non-industrial uses due to environmental contamination.

3.0 Site Description

SIC Description:	Organic Chemical Plant
SIC Code:	2869

Agricultural and organic chemicals manufacturing including insecticides, herbicides, polymers, and organic intermediates were manufactured within six production units at the facility. In addition to chemical production, plant activities included product formulation and packaging. Chemical production occurred in batches and fluctuated based on the season. New products were frequently introduced into production. Chemical processing at the production units included alkylation, amidation, carbamoylation, chlorination, distillation, esterification, acid and base hydrolysis, and polymerization (Environmental and Safety Designs, 1996).

3.1 Location

The former Cedar Chemical Corporation (CCC) West Helena Plant is located just to the south of Helena and West Helena, Arkansas. The plant is located within the Helena-West Helena Industrial Park, approximately one and one quarter mile southwest of the intersection of U.S. Highway 49 and State Highway 242.

3.2 Description of Current Conditions

CCC is currently bankrupt and manufacturing operations were shut down on March 8, 2002. The site was abandoned through a bankruptcy court in the State of New York on October 18, 2002. ADEQ issued Emergency Order of the Director LIS 02-148. ADEQ assumed site security and environmental management immediately upon abandonment. ADEQ is currently managing stormwater from the site through the existing wastewater treatment facility and discharge through the NPDES permitted outfall to the Mississippi River, maintaining essential utilities for environmental operations and maintenance, and providing security until the emergency situation is abated.

Stormwater accumulates on site during rain events and requires pumping to the wastewater treatment plant (to prevent uncontrolled discharges) and to the Mississippi River (for disposal). ADEQ periodically collects stormwater samples. Sample results confirm the presence of volatile and semi-volatile compounds in stormwater. Stormwater becomes contaminated upon contact with contaminated soils.

Manufacturing areas production units and some tanks were placed in mothball status by plant personnel prior to abandonment. Mothball status was achieved by removing raw materials, products, waste materials, and cleaning certain process equipment, piping and tanks. The extent of decontamination prior to abandonment was not well documented. USEPA Region 6 initiated an emergency removal of hazardous materials contained in piping, tanks and containers during the summer of 2003.

Approximately 6 drums of sodium hydroxide for use in water treatment and several drums of oil remain in the warehouse

Quality Control Laboratory chemicals and R&D laboratory chemicals were abandoned with the plant. USEPA Region 6 initiated an emergency removal of hazardous materials contained in piping, tanks and containers during the summer of 2003.

R&D laboratory underground waste storage tank (sump) currently contains waste materials of unknown composition and quantity. Historical operations pumped these wastes directly to the WWTP. The tank is presumed to accumulate all laboratory drains.

Wastewater treatment ponds currently contain contaminated stormwater, wastewater, and sludges. Water contained in the polish pond is stormwater from the plant runoff. Water contained in the equalization and biological ponds are primarily stormwater from the plant and some process wastewater residual. Process wastewater residual sludges have not been removed from the ponds.

Tanks containing potentially hazardous materials may be present on site. The extent of decontamination prior to abandonment was not well documented. USEPA Region 6 initiated an emergency removal of hazardous materials contained in piping, tanks and containers during the summer of 2003.

Secondary containment areas may contain stormwater. ADEQ does not actively manage all stormwater accumulated in secondary containment, and process containment areas. Equipment for pumping secondary containment and process containment areas abandoned at the site is mostly inoperable.

A number of personal property leased equipment has not been removed from the site including: forklifts, copiers, phone system, two 0.79 cubic foot mixed bed deionized water tanks. A complete list of leased equipment remaining on the site is not available.

All plant records (paper and electronic) remain onsite in the locations of abandonment.

3.2.1 Size of Site

The plant is located on 48 acres of the Helena-West Helena Industrial Park, approximately one and one quarter mile southwest of the intersection of U.S. Highway 49 and State Highway 242. The CCC plant property is divided into two major areas: the manufacturing area and the wastewater treatment system area. Industrial Park Road divides the two areas. The manufacturing area is about 30 acres.

3.2.2 Surface Property Improvements

Electrical service to the plant is provided by the Woodruff Electric Cooperative. There were 16 electrical service meters in use at the plant at the time ADEQ assumed site operations and up to 21 meters were reported by plant personnel. Eight meters were shut off at the direction of ADEQ in effort to reduce operation and maintenance costs. One additional meter was shut off by the Woodruff Electric Cooperative, due to apparent equipment problems. Seven meters are currently in service.

Water for the plant is supplied by the cities of Helena and West Helena through four entry metering points. One meter was shut off by the city due to concerns with contaminated soils and the absence of a backflow prevention valve. ADEQ currently uses two water meters for operations. The plant has a diesel powered firewater booster pump station.

The stormwater retention basin is designed to contain all runoff from the manufacturing area of the plant. The design capacity is 2.6 million gallons and was reported to be capable of containing up to 6.8 inches of precipitation. Two electrical stormwater pumps transfer water to the WWTP through underground piping.

The wastewater treatment plant (WWTP) is located across Industrial Park Drive from the manufacturing area. It consists of an eight million gallon equalization, a six hundred thousand gallon biological treatment, and a four million gallon polish ponds that are approximately 15 feet deep. The amount of sludge accumulated in each pond is unknown. The ponds were originally constructed in 1977 with a clay-like additive mixed into native soils and compacted for lining the ponds. Two electrical pumps with a combined capacity of 134 gpm connect the treatment ponds to a 4.5-mile underground pipeline to the Mississippi river for discharge through a permitted outfall. The polish pond has a 4 million gallon design capacity.

3.2.2.1 Buildings

Onsite buildings include an Office Complex, a R&D Laboratory, a QA/QC Laboratory, various warehouse buildings, employee changing station, truck scales, and various process control rooms. ADEQ procured services for real estate and equipment appraisals.

3.2.2.2 Above Ground Storage Tanks

ADEQ personnel made observations of above ground storage tanks and secondary containment areas during site visits. Observations are listed on the table below. Leak potential from the containment areas were ranked as high, medium, or low based upon observations of stormwater accumulation in the containment areas.

Tank Observations and Containment Leak Potential

Tank ID	Product Stored	Stormwater Containment Status	Shared Containment	Leak Potential
Unit 1	Process	Little Accumulation	Yes Process Unit	Moderate
Unit 1	Empty Tank Containment	No accumulation	Yes	High
Unit 2	Process	No Accumulation	Yes Process Unit	High
Unit 5	Process	Stormwater Accumulates	Yes Process Unit	Moderate
T5403	?	No Stormwater		High
T5204	Acedic Anhydride	Stormwater Accumulates		Low
T5203	Methanol	Stormwater Accumulates		Low
T5402	Formaldehyde	Stormwater Accumulates		Low
T5201	Sulfuric Acid	Stormwater Accumulates		Low
Unit 4	Process	Stormwater Accumulates		Low
T4208	Nitric Acid	Stormwater Accumulates		Low
T4205	?	Stormwater Accumulates		Low
T4201	Caustic Scrubber	Stormwater Accumulates		Low
T4213	20%Caustic Soda	Stormwater Accumulates		Low
T4212	Methanol	Stormwater Accumulates		Low
T4203	Acifluorfen	Stormwater Accumulates		Low
T1202	?	Stormwater Accumulates		Low
Unit 3	Process	No Stormwater		High
T1204	?	No Stormwater		High
T1201	Telene Waste	Active Leakage		High
T1226	Red Hydrobromic Acid	Little Accumulation		Moderate
T1230	?	Little Accumulation		Moderate
T1212	Kerosene	Little Accumulation	yes	Moderate
T3216		Little Accumulation		Moderate

Tank ID	Product Stored	Stormwater Containment Status	Shared Containment	Leak Potential
?	?	Little Accumulation		Moderate
T1206	Caustic Scrubber	Little Accumulation		Moderate
T1224	Acetic Acid	Little Accumulation		Moderate
T2212	Emulsifier	Little Accumulation	yes	Moderate
T3208	DCPI	Little Accumulation		Moderate
T1228	Emulsifier Vent Tank	Little Accumulation		Moderate
T2205	Propionic Acid	Little Accumulation		Moderate
T2206	Propionic Anhydrite	Little Accumulation		Moderate
T2211	Sun Oil	Little Accumulation		Moderate
T2209	Isophorone	Little Accumulation		Moderate
T2210	ISO MIBK	Little Accumulation		Moderate
T1225	Wash Solution	Stormwater Accumulates		Low
T1222		Stormwater Accumulates		Low
T2207	Tenneco	Stormwater Accumulates		Low
T1219	Toluene	Little Accumulation		Moderate
T1229	?	Stormwater Accumulates		Low
T2202	Propanil	Stormwater Accumulates		Low
T2203	Propanil	Stormwater Accumulates		Low
T2204	?	No Stormwater		High
T2200	Propanil	Stormwater Accumulates	Yes	Low
T2201	?	Stormwater Accumulates		Low
T2217	Propanil Tech	Stormwater Accumulates		Low
T2214	Propanil Flake Melt	Stormwater Accumulates		Low
T2213	?	Stormwater Accumulates		Low
Unit 6	DCA Plant	Stormwater Accumulates	Yes	Low
T6203	?	Stormwater Accumulates		Low
T6204	?	Stormwater Accumulates		Low
T6202	?	Stormwater Accumulates		Low
T6201	?	Stormwater Accumulates	Yes	Low
T0223	Calcium Chloride	Stormwater Accumulates		Low
T6210	?	Stormwater Accumulates		Low
?	?	Stormwater Accumulates		Low
T6205	?	Stormwater Accumulates		Low
Unit 7	Therminol	NA		NA

Note: Shared containment means there are no containment divisions between tanks.

3.2.2.3 Disposal Areas

The maintenance warehouse (Site 5 in FI, SWMU 72 RFA) building foundation was constructed as a waste disposal vault in the early 1970's. Two to three hundred drums of unknown waste materials are reported to be in the foundation of the building. No records were found describing what was in the drums. The disposal unit was never permitted by ADPC&E or its successor ADEQ.

Former wastewater treatment ponds (Site 2 in FI, SWMUs 69, 70, and 71 RFA) were used for elementary neutralization and waste disposal from 1972 through 1977. These ponds functioned primarily as an infiltration system, and were not permitted for discharge to surface water. A number of uncontrolled releases were reported during the early 1970's.

Drum disposal areas were unearthed during pre-construction activities in the early 1990s of Unit 6 (DCA plant). Further characterization (*Site Characterization and Drum Disposal Area Delineation Work Plan*, May 1990) and removal activities were done under a CAO issued by ADPC&E. The *Site Characterization Report*, June 1990, provided general site characterization of construction areas for the DCA plant and associated tank farm, the Administration Building, and delineation of a drum disposal area. Further characterization of other potential drum disposal areas within the construction areas were reported in *Geophysical Survey and Soil Sampling Program*, March 1992. Two additional drum disposal areas were identified. All three of the drum disposal pits were reported constructed in December 1972 by plant personnel. Contents of the drums were determined to be primarily Dinoseb produced by a former operator Ansul Corporation. Drum burial activities were believed to be done by employees of either Eagle River Chemical Corporation or Helena Chemical Corporation. (Memorandum from Allen Malone to Environmental Safety Designs, 8-26-92)

Other disposal trenches were constructed for the disposal of Dinoseb wastes and products around 1972. Approximate location was disclosed through depositions from former employees and was presented in Appendix A of the *Facility Investigation Preliminary Report*, September 15, 1992. Subsequent facility investigations confirmed the presence and defined the approximate extent of the disposal areas. The results of the investigations of this disposal area are presented as Site 9 in the *Facility Investigation Report*, June 26, 1996.

3.2.2.4 Paved Areas

The central manufacturing areas are mostly paved. Paving was used to cover some soils that were visibly stained yellow with the product Dinoseb that was formerly manufactured in the early 1970s.

3.2.3 Location of Subsurface Features

One underground storage tank is located behind the R&D Laboratory containing unknown amounts of contaminants.

A former underground wastewater pipeline traverses the site from the vicinity of Unit 5 along the eastern side of the property. Although it was reported this line was replaced with above ground piping, this pipe was determined to be a significant source of 1,2-dichloroethane in historical operations. This subsurface feature may be a continuing source of groundwater contamination.

Site 5 Drum vault is located in the foundation of the maintenance warehouse and was reported to contain 200-300 drums of waste materials. Investigations showed the area to be highly contaminated. Site 5 sits on Site 9 and it is therefore unknown if the drum vault contributed to contamination or if the high levels of contaminants were solely those of Site 9. This subsurface feature may be a continuing source of groundwater contamination.

Site 9 Former Dinoseb Ponds were reported to be disposal sites for Dinoseb products and waste materials. Investigations showed the area to be highly contaminated. Site 5 sits on Site 9 and it is therefore unknown if the drum vault contributed to contamination. This subsurface feature may be a continuing source of groundwater contamination.

Site 2 Former Wastewater Treatment Ponds were reported to be historical disposal sites used by previous operators and other industry. Investigations showed the ponds to be highly contaminated. This subsurface feature may be a continuing source of groundwater contamination.

Other underground disposal areas have been reported in the Site 4 area. During the installation of monitoring wells 4MW-1 (near the Unit 1 expansion area) and 4MW-2 (between the Unit 3 expansion area and Unit 4) unusual conditions were encountered. At well 4MW-1 a pocket of gas was encountered in the semi-confined portion of the alluvial aquifer. An explosimeter on the drill rig sounded an alarm indicating the presence of explosive gas. PID reading at the augers indicated a concentration of 144 ppm organic vapors. The gas was sampled with Draager tubes and it was concluded that concentrations were too high to be accurately quantified by that method. Well 4MW-2 was installed approximately 160 feet southwest of well 4MW-1 and no gas was encountered, but soil cores retrieved from the alluvial sands was saturated yellow to orange foamy water (*Facility Investigation*, EnSafe, June 1998).

3.2.3.1 Underground Storage Tanks

There is one known underground storage tank containing waste materials at the plant. The tank apparently accumulated wastewater from one or both the laboratories and sewer. The tank is located behind the R &D laboratory on the west side of the building. It appears the tank may be connected or capable of being connected with underground piping and associated pumping equipment. Accumulated wastewater was pumped to the wastewater treatment plant, based upon interviews with former plant personnel. It is unknown if this tank was associated with a leach field. This tank is listed as SWMU 10 Laboratory Sump in the RFA.

3.2.3.2 Piping

Most of the underground piping associated with wastewater management was replaced with above ground piping during the 1990's. Underground piping remains behind the main warehouse (southeast corner of the manufacturing area) where wastewater and stormwater piping cross Industrial Park Drive to the WWTP. A 4.5 mile underground pipeline to the Mississippi river from the wastewater treatment plant is used for the NPDES discharge.

3.2.4 Operational Status

The plant was placed in mothball status during the final days of bankruptcy prior to abandonment. The operational status is largely unknown based upon available documentation.

All areas of the plant may be considered operational based upon the presence of process equipment. Not all areas of the plant have utilities turned on.

3.2.5 Security

ADEQ currently has a contractor that provides 24 hours per day, 7 days per week site security. The manufacturing area and wastewater treatment areas are fenced with locked gates to prevent unauthorized entry.

No trespass and signs warning of unauthorized entry are posted on the main entrances to the plant and perimeter fencing.

3.2.6 Surrounding Land Use

The plant is bordered by farms, State Highway 242, the Union-Pacific Railway, and other industrial park properties. Residential areas are located within one-half mile to the southwest and northeast of the CCC site (Environmental and Safety Designs, 1996).

4.0 Site History

Prior to 1970, the land was used for agriculture. In 1970, Helena Chemical Company acquired the site for construction of a Propanil and Methoxychlor manufacturing facility. In 1971, the plant was sold to Jerry Williams, who transferred the plant to Eagle River Chemical Corporation, which was initially controlled by Ansul Company. Under Ansul's management, the plant was converted for production of dinitorobutylphenol (Dinoseb). In 1973, Jerry Williams purchased the Eagle River Chemical Corporation, and retained the name Eagle River Chemical. Subsequently, the Eagle River Chemical Corporation merged into the Vertac Chemical Corporation. In 1986, the plant was sold to Cedar Chemical Corporation, which currently owns the facility (Environmental and Safety Designs, 1996).

4.1 Operational History

The plant originally opened for the production of various herbicides, pesticides, organic chemicals, and inorganic chemicals. The plant was a custom chemical manufacturer throughout its operational history.

4.1.1 Manufacturing

Production Units 1 and 4 manufactured various custom products, Production Unit 2 produced Propanil, Production Unit 5 manufactured nitroparaffin derivatives, and Production Unit 6 produced dichloroaniline. Production Unit 3 manufactured herbicides (RP-10), benzene sulfonyl chloride, alkylated phenol, and methylthiopinacolone oxide (MTPO) until it was destroyed in an explosion and fire on September 26, 1989.

At the time of bankruptcy, the Air Permit listed the following processes:

Unit 1 could produce and/or process the following products or product intermediates: BFG Resin, Pentabrom, Metolachlor, Cyclanilide (re-wash from Unit 5), Methanol Recovery, 2-Amino-1-Butanol (2-AB) (distillation from Unit 5), Ro-Neet.

Unit 2 produced Propanil exclusively.

Unit 3 produced Diuron and MACE CS.

Unit 4 produced Aciflourfen exclusively.

Unit 5 could produce the following products or product intermediates: Tramethamine, Ticona, Cyclanilide, 2-Amino-1-Butanol (2-AB).

Unit 6 produced 3,4-Dichloroaniline (DCA) exclusively.

4.1.2 Hazardous Substances

USEPA Region 6 initiated an emergency removal of hazardous materials contained in piping, tanks and containers during the summer of 2003. Hazardous substances included: acetic acid, benzoic acid, carbon tetrachloride, butylamine, 4-chloroaniline, 2-chloroethyl ether, copper, copper cyanide, cumene, 2,6-dichlorobenzonitrile, 1,2-dichloroethane, dichlorotoluene, Dimethyl sulfate, 2,4-dinitrotoluene, diphenylamine, ethylamine, ethylene oxide, formic acid, formaldehyde, hexachlorobenzene, hydrofluoric acid, nitrobenzene, p-nitrobenzene, pentachloronitrobenzene, potassium cyanide, pyridine, quinoline, sodium cyanide, sodium fluoride, sodium nitrite, 1,2,4-trichlorobenzene, triethylamine, zinc. All of these chemicals are "hazardous substances" as defined by Section 101(14) of CERCLA, 42 U.S.C. § 9601(14), and 40 CFR § 302.4. (EPA Action Memo 2003)

4.2 Ownership History

The facility was originally constructed in 1970 by Helena Chemical Company. In 1971, the company was sold to J.A. Williams, which transferred the plant to Eagle River Corporation, a company controlled by Ansul Company. In 1972, Ansul sold its interest in Eagle River Corporation back to J.A. Williams and the company was merged into Vertac Chemical Company. Vertac Chemical Company owned the facility until 1986. Cedar Chemical Corporation acquired the facility in 1986. Trans Resources, Inc. purchased Cedar Chemical Corporation in 1988. Nine West, a holding company owned by Trans Resources, owned Cedar at the time of bankruptcy.

4.3 Past Regulatory Involvement

The plant was constructed and began operations before the passage of the Clean Air Act, the Clean Water Act, CERCLA, and RCRA. Operations began before permitting under Federal authorities. The Arkansas Department of Pollution Control and Ecology (ADPC&E) became initially involved by citizen complaints related to uncontrolled discharges of water and odors shortly after production began in the early 1970s. ADPC&E was a newly formed agency established through the Arkansas Air and Water Pollution Control Act.

4.3.1Permits

ADEQ Minor Source Air Permit #: 878-AR-13
ADEQ NPDES Permit # AR0036412

4.3.1.1 Air

Permit 126-A was issued to Eagle River Chemical Corporation on 7/28/72 for the manufacture of 3,4-Dichloropropionanilide (Propanil).

Permit 126-AR-1 was issued to the Eagle River Chemical Corporation on 11/19/76 to include manufacture of Nitro Benzoate Ester, Methomyl, and Basalin.

Permit 126-AR-2 was issued to the Eagle River Chemical Corporation on 9/29/78 to replace a steam jet vacuum device with a vacuum pump.

Permit 126-AR-3 was issued to Vertac, Incorporated on 11/16/79 to include manufacture of Permethrin and Cypermethrin.

Permit 126-AR-4 was issued to the Vertac Chemical Corporation on 11/16/79 to include expansion of the DRA production unit.

Permit 878-A was assigned to the Cedar Chemical Corporation on 4/4/88 to update the existing air permits.

Permit 878-AR-2 was issued to Cedar Chemical Corporation on 12/12/89 to include production of Tris (hydroxymethyl) aminomethane (TA), 2-amino-butanol (2AB), and 2-amino-2-propanol (AMP) in unit 5.

Permit 878-AR-3 was issued to Cedar Chemical Corporation on 7/10/90 to include manufacture of Telene polymer resin in Unit 1 and 3,4-Dichloroamine (DCA) in Unit 6.

Permit 878-AR-4 was issued to Cedar Chemical Corporation on 9/17/91 to include manufacture of Di 2-Ethylhexylphosphorice Acid (DEPHA) in Unit 4.

Permit 878-AR-5 was issued to Cedar Chemical Corporation on 11/12/91 for the production of Sectagon and Cobra in Unit.

Permit 1351-A was issued to Cedar Chemical Corporation on 12/15/92 for the production of ADPA, a cleaning agent, in Unit 4.

Permit 878-AR-6 consolidated permits 878-AR-5 and 1351-A , removed production of Methyl Ethyl Sulfide (MES) and production of Methyl 2-Benzimidazole Carbamate (MBC), and authorized production of TCDNB, Diuron, and the bleach process. This modification also assigned individual emission rates to existing boilers and oil heaters.

Permit 878-AR-7 was a minor modification allowing for the production of Graphsize A in Unit 4.

Permit 878-AR-8 was a minor modification allowing for the production of Suresize 25 and Suresize 30 in Unit 1.

Permit 878-AR-9 was a minor modification allowing for the production of Tritolyl phosphite (TTP) in Unit 4 and production of Diuron in Unit 2 (Diuron is normally produced in Unit 5).

Permit 878-AR-10 was issued to Cedar Chemical Corporation on 2/3/98 to add Unit 3 for production of Diuron, add a new boiler, update all tank information, and update many equipment changes authorized through letters from the Department.

Permit 878-AR-11 was issued to Cedar Chemical Corporation on 8/23/01 to incorporate several De Minimis applications submitted by the facility that included the addition of Stanol in Unit 5, the addition of Pentabrom in Unit 1, the installation of a new product dryer to remove 1,4 Dichlorobenzene from Ticona in Unit 1, the addition of the MACE CS recovery in Unit 3, the addition of Metolachlor in Unit 1, the addition of Cyclanilide in Unit 5 and its washing in Unit 1, the installation of a methanol recovery process into Unit 1, and the addition of 2-Amino-1-Butanol (2-AB) in Unit 5.

Permit 878-AR-12 was issued to Cedar Chemical Corporation on 1/25/02 to allow for distillation of 2-Amino-1-Butanol (2-AB) in Unit 1. Emissions were routed through the Unit 1 Scrubber (SN-01d) with water being the scrubber liquid. In addition, this modification allowed increases in the monthly raw material throughput and production levels for the Diuron process in Unit 3. There will be no change in the hourly or annual emissions to the Unit 3 process.

4.3.1.2 Water

The facility currently holds NPDES permit No. AR0036412. The permittee submitted a permit renewal application on April 25, 2001. The current NPDES permit was reissued for a 5-year term in accordance with regulations promulgated at 40 CFR Part 122.46(a). The facility is authorized to discharge from a facility located at Highway 242 South in Section 14, Township 2 South, Range 4 East in Phillips County, Arkansas, Latitude: 34° 31' 13"; Longitude: 90° 39' 10", to receiving waters named Mississippi River in Segment 6B of the Mississippi River Basin. The outfall is located at the following coordinates: Outfall 002:

Latitude: 34° 29' 55"; Longitude: 90° 35' 29". This permit became effective on June 1, 2002, and the authorization to discharge expires at midnight, May 31, 2007.

4.3.1.3 Hazardous Waste

In November 1980, Vertac Chemical Corporation filed a Resource Conservation and Recover Act (RCRA) Part A permit application with the Arkansas Department of Pollution Control and Ecology (ADPC&E). Subsequently, interim status was granted for a hazardous waste storage tank, a hazardous waste container storage area, and a biological treatment lagoon. Vertac submitted a RCRA Part B application on August 15, 1984. In November 1984, Vertac Chemical Corporation requested that the biological treatment lagoon be removed from the list of interim status facilities requiring a RCRA permit because the system was not used to treat hazardous waste. ADPC&E approved this request on November 16, 1984 (ADPC&E, 1984). CCC submitted a revised RCRA Part A permit on March 1, 1986. The two storage units were RCRA closed in 1988, with no post-closure care required. Thus, the Part B application was not processed and a RCRA permit was not issued.

4.3.1.4 Consent Administrative Orders

On May 30, 1986, ADPC&E conducted a compliance evaluation inspection (CEI) and observed violations. As a result, ADPC&E issued a notice of violation on December 19, 1986, indicating that CCC was disposing of hazardous waste to the biological treatment ponds and that a sump pump within the container storage area was broken at the time of the CEI. Subsequently, Consent Administrative Order (CAO) No. LIS 86-027 was issued on July 16, 1987, to CCC, which essentially required them to stop disposing of hazardous waste to surface impoundments and investigate potential release(s) to surrounding media.

On June 26, 1990, CCC was informed of a violation that was observed during another CEI. The violation involved the disposal of contaminated monitoring well purge water directly onto surface soil.

ADPC&E issued CAO No. LIS 91-118, requiring CCC to conduct a facility investigation (FI). Field activities for Phase I of the FI began on August 30, 1993. Two additional phases (Phase II and III) of the FI were conducted in 1994 and 1995, respectively. In 1996, a FI report was submitted that summarized all three phases of the FI and recommended that additional sampling be conducted as part of a corrective measures study (CMS).

On May 5, 1993, ADPC&E conducted a CEI and violations were observed. The CEI report indicated that CCC failed to determine if a solid waste was hazardous waste in accordance with APC&EC Regulation 23 Section 262.11 and failed to comply with the requirement of personnel training in accordance with APC&EC Regulation 23 Section 262.34(a)(4).

On May 27, 1998, Arkansas Department of Environmental Quality (ADEQ), the successor agency to ADPCE, conducted a CEI and observed violations. The CEI report indicated that CCC had been accumulating hazardous waste for more than 90 days in an unpermitted unit. Subsequently, ADEQ issued CAO No. LIS 99-131, which required CCC to achieve and maintain compliance with Arkansas state regulations.

On June 4, 2002, ADEQ conducted a CEI and noted that CCC was accumulating hazardous waste for more than 90 days in an unpermitted unit and relinquished hazardous waste to an unpermitted transporter. In an August 14, 2002 letter, ADEQ required that CCC submit manifests to ADEQ for the waste being shipped off-site by a permitted transporter and to a permitted treatment, storage, and disposal facility (TSDF).

4.3.1.5 Investigation Reports

Dioxin Sampling, Vertac Chemical, West Helena, Ecology and Environment Memorandum from Tom Smith, February 1985
Sampling Mission Results from the Vertac-West Helena Site, EPA/Ecology and Environment Inc., July 1986
Surface Impoundment Sampling and Analysis Report, Sorrells Research Associates Inc., March 1988
RCRA Facility Assessment PR/VSIReport, EPA, 1988
Hydrogeologic Study, Grubbs Garner and Hoskyn Inc., July 1988
Final Report of Installation and Analysis of a Groundwater Monitoring Well System CAO LIS 86-027, Letter from Joe Porter, June 1990
Final Groundwater Report CAO LIS 86-027 Engineering Evaluation, Letter from Joe Porter, August 1990
Site Characterization Report DCA Process Area, New Administration Building, Original Tank Farm Area, Tank Farm Area, Woodward-Clyde Consultants, June 1990
Geophysical Survey and Soil Sampling Program, Groundwater Services Inc., March 1992
Technical Memorandum, EnSafe, December 1993
Facility Investigation, EnSafe, March 1995
Facility Investigation Report, EnSafe, June 1996
Quarterly Groundwater Monitoring Report, EnSafe, June 1996
Second Quarterly Groundwater Monitoring Event, EnSafe, February 1997
Risk Assessment, EnSafe, October 1999
Groundwater Monitoring Report, September 2001
Risk Assessment Addendum, EnSafe, January 2002

4.3.1.6 Certifications, Registrations, and Licensing

There are no product registration labels currently owned by the pre-bankruptcy estate. Product registration labels historically were jointly owned by Riceco LLC and CCC. CCC owned less than 50 % interest in Riceco. CCC's shares of the registration labels were sold along with its interest in Riceco following bankruptcy.

Wastewater operator license is required by the NPDES permit for employees that that manage the wastewater treatment plant. The operator of this wastewater treatment facility is required to be licensed by the State of Arkansas in accordance with Act 1103 of 1991, Act 556 of 1993, Act 211 of 1971, and Regulation No. 3, as amended.

5.0 Environmental Setting

Arkansas has a humid mesothermal climate that is typical of the southeast and south-central United States. The mean annual precipitation is 50 inches, and typical the maximum precipitation events occur between February and April. The mean annual temperature is 62.7 °F. The prevailing wind direction is to the southwest at an average speed of eight miles per hour (mph) and travels in that direction 12.3 percent of the time (Environmental and Safety Designs, 1996).

CCC is located approximately two miles west of the Mississippi River within the Mississippi Embayment Region of the Gulf Coastal Plain. The topography of the land is relatively flat with gentle slopes oriented to the southeast. Ground surface elevations at the site vary from approximately 188 feet above mean sea level (msl) in the southwest to 200 feet above msl in the northeast (Environmental and Safety Designs, 1996).

Phillips County is an attainment area for all primary and secondary air pollutants.

5.1 Hydrogeology

The alluvial aquifer is a major source of groundwater for agricultural use in eastern Arkansas. The alluvial deposits provide groundwater for irrigation wells in the areas surrounding Helena and West Helena, Arkansas. The irrigation wells are reportedly capable of producing approximately 1,000 gallons per minute (gpm). Domestic and municipal water supplies are typically obtained from the Sparta Sand/Memphis Sand aquifer system, which underlies the Jackson-Claiborne Group. Regional groundwater flow in the Sparta Sand is generally to the southeast toward the Mississippi River (Environmental and Safety Designs, 1996).

5.1.1 Regional

The surficial and near surficial soil consists of alluvial deposits of fine grained sands and silt from the Quaternary Age. The Quaternary alluvium in eastern Arkansas is generally comprised of an upper layer of silt and clay and a bottom layer of sand and gravel. The alluvial deposits are approximately 150 feet thick. The alluvium is typically the surface stratum in this region, except where Tertiary formations, such as Crowley's Ridge, outcrop. The bottom of Quaternary deposits sits on the erosional surface of older Cretaceous and Tertiary formations (Environmental and Safety Designs, 1996).

Underlying the alluvial deposits are the undifferentiated Jackson and Claiborne Groups of the Tertiary Age. The Jackson Group serves as a confining bed, as it is chiefly composed of clay with fine sand lenses; no water is typically produced from this stratum. The Claiborne Group is predominantly silty clay with thin, discontinuous beds of silty clay and lignite. The Jackson Group is generally made up of gray, brown, and green silty clay with peat and lignite. In the vicinity of the site, the Jackson Clay is approximately 250 feet thick (Environmental and Safety Designs, 1996).

The lowermost geologic unit of concern at the site is the Sparta Sand. The Sparta Sand is comprised of primarily gray, very fine to medium sand with brown and gray sandy clay. This formation is likely to have been a beach deposit of a transgressing sea and ranges in thickness from 300 to 400 feet. The Sparta Sand serves as the major deep source of potable groundwater in the Helena/West Helena area (Environmental and Safety Designs, 1996).

5.1.2 Local

The general stratigraphic succession beneath the site from surface to depth includes surface soil and loess within fluvial alluvium, fluvial alluvium aquifer deposits (coarsening downward), Jackson Clay Group, and Sparta Sand. The primary focus of the 1993 FI field activities was the sampling of the alluvial deposits. Based on the sampling of the alluvium, five separate stratigraphic units were identified within the alluvial section beneath the site. Field activities involved only minimal sampling of the Jackson Clay, with no sampling of the Sparta Sand (Environmental and Safety Designs, 1996).

5.1.2.1 Lithology

During FI field activities, five distinct units were observed at the site. A fining upward sand and gravel sequence from the surface of the Jackson Clay was present at approximately 135 to 150 feet below ground surface (bgs). Overlying this unit is a fining upward sand sequence, ranging from poorly sorted coarse sand, at 135 feet bgs, to very fine silty sand at the top of the sequence, at approximately 40 feet bgs. Lignite and organic matter are associated with this alluvial unit. From the top of the alluvial sands to the ground surface, an interbedded, very stiff to firm, tan, gray, and brown silty clay and clayey silts were encountered. The silty clays and clayey silts were addressed as two distinct units during the FI field activities. The lower of the two units overlies the alluvial sands and gravels. This unit consists of a tight, gray to olive-gray clay with silt ranging from approximately 15 to 20 feet thick. This clay unit acts as a semiconfining unit at the site due to its low permeability rate; the contact between this semi-confining unit and the alluvial sands serves as a distinct layer. The second of the two units is surficial sediment comprised of a light brown to brown silt and silty clay layer extending from the surface of the gray clay to the ground surface. The contact between the semiconfining unit and the surficial sediments is another distinct layer observed within the alluvial deposits. (Environmental and Safety Designs, 1996).

Unit 1 from ground surface to 32 feet below ground surface (bgs) consists of silts, clays and sands. Unit 1 corresponds to surficial sediments.

Unit 2 from 32 to 47 feet bgs consists of clays and silts. Unit 2 corresponds to the semi-confining unit.

Unit 3 from 47 to 116 bgs consists of a coarsening downward sand sequence with clay stringers. Unit 3 corresponds to the upper 70 feet of the alluvial aquifer.

Unit 4 from 116 to 131 feet bgs consists of clay. Unit 4 is the middle section of the alluvial aquifer. This unit was not observed through borehole logging but was indicated by geophysical logging.

Unit 5 from 131 to 152.3 feet bgs consists of sand. Unit 5 is the lower section of the alluvial aquifer that overlies the regional confining layer (Jackson clay). This unit was not observed through borehole logging but was indicated by geophysical logging.

5.1.2.2 Depth to Groundwater

The site is underlain by several units of unconsolidated Quaternary and Tertiary age sedimentary deposits. Two aquifer regimes exist at the site, including a minor discontinuous perched zone in the silt and clay surficial sediments and the primary alluvial aquifer in the sand and gravel zones. The discontinuous perched zone was identified at Sites 1 and 2 in disturbed soil or fill overlying a surficial clay unit; water was encountered between 10 and 20 feet bgs. Perched groundwater was not encountered on top of the clay in the northern portion of the site. The clay unit is approximately 10 to 20 feet thick (Environmental and Safety Designs, 1995).

The alluvial aquifer ranges from 30 to 40 feet bgs to approximately 150 feet bgs, where it contacts the Jackson-Claiborne Group stratum of clay and lignite materials. The alluvial aquifer is comprised of silty sand, sand, and fine to coarse-grained gravel. Locally, the aquifer appears to be confined by the upper 40 feet of silt and clays, and acts as a confined or semi-confined aquifer. The Jackson Clay is the basal confining unit for the alluvial aquifer in this region of Arkansas (Environmental and Safety Designs, 1995).

Data obtained during the Phase II Investigation reflect a 4-foot rise in head between November 1994 and January 1995, groundwater elevations from the April 1996 event are 1 to 2 feet lower than those measured during January 1995. These data indicate that the unit is dynamic and responsive to seasonal fluctuations in rainfall (*Facility Investigation*, EnSafe, June 1996).

5.1.2.3 Uppermost Aquifer

The uppermost aquifer (Alluvial aquifer) is contained within Quaternary aged deposits of gravel, sands, and silts within the alluvial floodplain of the Mississippi alluvial plain. The Alluvial aquifer is characterized by a fining upward sequence of gravel, sands and silts attaining a maximum thickness of 200 feet in the region. These deposits are approximately 150 feet thick beneath the site. Portions of the upper soils apparently consist of outwash from Crowley's Ridge as evidenced by the relatively high silt content. The alluvial aquifer is a major source of groundwater throughout the Mississippi Embayment. The Alluvial aquifer has a long history of use for drinking water and irrigation.

The perched groundwater, although discontinuous, appears to be hydraulically connected to the alluvial aquifer.

5.1.2.4.Confining Layers

Underlying the alluvial deposits are the undifferentiated Jackson and Claiborne Groups of the Tertiary Age. The Jackson Group serves as a confining bed, as it is chiefly composed of clay with fine sand lenses; no water is typically produced from this stratum in the general area of the site. The Claiborne Group is predominantly silty clay with thin, discontinuous beds of silty clay and lignite. The Jackson Group is generally made up of gray, brown, and green silty clay with peat and lignite. In the general vicinity of the site, the Jackson Clay is approximately 250 feet thick (Environmental and Safety Designs, 1996).

5.1.2.5 Groundwater Flow Direction and Gradient

Groundwater in the alluvial aquifer flows predominantly south to southwest, at an average flow gradient of 0.0006 feet/foot. The transmissivity of the aquifer is 30,000 ft ^{2} /day and the hydraulic conductivity is 273 ft/day. These were established from slug tests performed in the investigations. Effective porosity of the aquifer was estimated to be 20%. The groundwater flow velocity was calculated to be 0.82 ft/day or 299 feet per year in the lower alluvial aquifer.

Groundwater in the perched interval at Site 1 flows to the southwest at a gradient of 0.01 feet/foot. Groundwater elevations varied significantly (more than 5 feet) between monitoring events, and do not trend consistently up or down, suggesting that water levels are highly dependent on seasonal rainfall (*Facility Investigation*, EnSafe, June 1996).

5.1.2.6 Groundwater Quality

The alluvial aquifer is recognized as a Class 1 aquifer and therefore recognized as having good water quality that is suitable for most purposes.

Water pumped from the alluvial aquifer is typically a calcium bicarbonate type, which contains appreciable amounts of magnesium and iron. Other dissolved constituents in the water, but in comparatively small concentrations, include sodium, chloride, potassium, sulfate, silica, nitrate, fluoride, and manganese. Hardness and dissolved iron in the water of the alluvial aquifer generally limit its use for municipal, industrial, and domestic supplies unless it is treated (*Water Resources Circular No. 13*, USGS/AGC, 1982).

5.2 Soils

The upper six feet of soils at the site were described and classified as the Convent Series. This soil series is comprised of somewhat poorly drained, level soil that develops on alluvial fans at the foot of Crowley Ridge, which is a major regional structural feature. The soil of the Convent Series is characterized by medium-to-low organic matter content, moderate permeability, and high available water capacity. The Convent Series is predominantly made up of friable silt loam with granular structure, roots, and organic matter present at the uppermost horizon. Underlying this layer exists a series of horizons comprised of silt loam parent material with platy structure and mottling that increases in abundance and distinction with depth (Environmental and Safety Designs, 1996).

5.3 Surface Water

Surface water bodies on the CCC site or in the vicinity of the CCC site include a wetland, industrial park ditch (a tributary of Chaney Creek), Chaney Creek (a tributary of Beaver Bayou), Beaver Bayou (a tributary of Big Creek), Big Creek (a tributary of the White River), the White River and the Mississippi River.

All surface water runoff from the facility is directed to the stormwater drainage system (SWMU 59). This system drains into the storm water sump (SWMU 60). When the capacity of the sump is exceeded, the system drains to National Pollutant Discharge Elimination System (NPDES)-permitted Outfall #001. This outfall drains to the industrial park ditch adjacent to the facility. The industrial park ditch drains to Chaney Creek, then to Beaver Bayou, then to Big Creek and eventually to the White River. Effluent from the wastewater treatment system is pumped off site through a 4.5-mile pipeline to NPDES-permitted Outfall #002, where it is discharged directly into the Mississippi River. NPDES Permit AR0036412 was issued to CCC in September 1985 and renewed in September 1990.

5.3.1 Runoff Pathways

Surface runoff generally flows toward the southwest to tributaries of the White River and eventually into the Mississippi River. Localized changes in topographic relief are attributable primarily to anthropogenic alterations made for construction, or for directing surface water runoff. Because the topography of the region is relatively flat, overland flow velocities are low and some areas where the original ground surface has not been modified are poorly drained

5.3.1.1 Natural

The natural drainage pathway from the site is to industrial park ditch (a tributary of Chaney Creek), Chaney Creek (a tributary of Beaver Bayou), Beaver Bayou (a tributary of Big Creek), Big Creek (a tributary of the White River), the White River and eventually to the Mississippi River.

5.3.1.2 Man Made

To improve drainage, unlined storm water drainage ditches have been constructed to divert runoff water to retention and treatment basins. Stormwater historically was discharged into an un-named industrial park ditch adjacent to the wastewater treatment facility through the NPDES permitted outfall #001. Discharge to outfall 001 was eventually terminated due to non-compliance associated with chronic toxicity. Cedar conducted a Toxicity Reduction Evaluation during the mid 1990's and re-routed all stormwater to the wastewater treatment facility.

The central drainage ditch and central manufacturing area has been observed to flood during periods of heavy precipitation. Although flooding has been observed, there are no indications of manufacturing interruptions reported by plant personnel. Plant maintenance personnel historically responded as needed to storm events to prevent interruptions to manufacturing, damage to equipment, and uncontrolled discharges.

5.3.2 Distance to Receiving Surface Waters

The wetland is adjacent to the wastewater treatment system. Beaver Bayou is located near the industrial park ditches. The Mississippi River is located approximately four miles east and Big Creek is located approximately 15 miles southeast of the CCC facility.

5.3.2.1 Potential Receptors

Arsenic, Aldrin, Dieldrin, 4,4'-dichlorodiphenyldichloroethylene (4,4'-DDE), 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD), 4,4'-dichlorodiphenyltrichloroethane (4,4'-DDT), Endrin, gamma-BHC, Methoxychlor, and Toxaphene were detected in sediment at Area I above the EPA Region 4 sediment screening values. Two potential receptors (tadpoles and piscivorus birds) were identified in the *Risk Assessment*. Tadpoles in the ditches may potentially be exposed to contaminated sediment identified in the ditches. Because of the nature of contamination in sediment, bioaccumulation is possible. In addition, piscivorus birds may also ingest tadpoles with elevated levels of pesticides. However, the *Risk Assessment* indicates the potential risk in Area I was considered acceptable because the ditches are used as an integral component of the facility's wastewater treatment system. Due to the function of these ditches, standing water is frequently drained and, thus, any emerging aquatic habitat was considered opportunistic (Ensafe, 1999).

No potentially complete ecological exposure pathways for Area II were identified in the *Risk Assessment* (Ensafe, 1999).

In Area III, an ecological potential pathway identified in the *Risk Assessment* included receptors exposed to contaminated groundwater during irrigation activities. However, ecological risks were not evaluated since no data was available from the irrigation wells at the time the *Risk Assessment* was conducted. The risk assessment indicated that only small mammals and birds species are present in Area III. The risk assessment indicated that during hot summer months when irrigation is frequent, wildlife species are likely dormant during the heat of the day and seek refuge in wooded areas. Thus, exposure to contaminated groundwater during irrigation events was not anticipated to be significant for potential ecological receptors (Ensafe, 1999).

Surface runoff from the site is controlled. Potential human receptors are discussed separately in Section 7 Human Health Risk Assessment. Potential human receptors include exposures to irrigation water offsite and stormwater onsite.

5.3.3 Flood Plains

CCC is not in the 100-year floodplain of the Mississippi River (Environmental and Safety Designs, 1996).

5.4 Ecology

Three ecological areas of concern were identified in the 1999 Risk Assessment. Area I consists of three ditches on site that make up the storm water retention system. Area II consists of an approximately two-acre isolated wetland located on the southwest boundary of the plant property. Area III includes all adjacent off-site non-industrial areas (Ensafe, 1999).

It should be noted that although three ecological areas of concern were identified in the 1999 Risk Assessment, only one area (Area I) was evaluated in the risk assessment because no relevant data (surface soil, sediment, or surface water) were collected at Areas II and III (Ensafe, 1999).

5.4.1 Plant Populations

The dominant wetland vegetation identified during the June 4, 1999 ecological survey in area II consists of Black Willow (Salix nigra), Chickasaw Plum (Prunus anjustifolia), common Cattails (Typha latifolia), Floating Primrose Willow (Ludwgia spp.) and duckweed (Lemna spp.) (Ensafe, 1999).

5.4.2 Animal Populations

During the June 4, 1999 ecological survey, two species of tadpoles (Bullfrog [*Rana catesbeiana*] and Southern Leopard [*Rana utricularia*]) were observed in the ditches. Two species of birds were also feeding in and around the ditches. The Killdeer (*Charadrius vociferus*), which is a farm country plover, usually inhabits fields, airport, lawns, riverbanks, and shores. In addition, the Green Heron (*Butorides striatus*), which feeds on a variety of fish, frogs, crawfish, insects, and other aquatic life, was identified (Ensafe, 1999).

5.4.3 Potentially Affected Ecosystems

Area I consists of three on-site ditches that served as a storm water retention system, which is a component of the wastewater treatment system. These open ditches are vegetated with various grasses along the edges, and submergent plants are present in more frequently submerged portions.

Area II consists of a two-acre isolated wetland constructed in 1978 to serve as an overflow retention pond for the wastewater treatment system. Once the pond was excavated, it was determined that an overflow system was not necessary; therefore, a connection between the treatment system and ponds was never installed. Over the years, the excavated area developed wetland characteristics through natural secession and now meets the U.S. Army Corps of Engineers (USACE) definition of a wetland (Ensafe, 1999).

Area III includes all off-site non-industrial areas within one mile of the facility. These areas include agriculture farm lands, ditches, and tributaries to Big Creek. Approximately 99 percent of Area III is cultivated with cotton, soybeans, or winter wheat. The tributaries discharge to Big Creek approximately 15 miles southeast of the facility (Ensafe, 1999).

5.4.3.1 Endangered Species

According to the 1999 risk assessment, there are 16 State and Federal listed threatened and endangered species in Phillips County; however, none of these species has been identified at or in the general vicinity of the CCC site (Ensafe, 1999).

5.4.3.2 Sensitive Environments

No ecologically sensitive water bodies are indicated by APC&EC Regulation 2 within the potentially impacted surface drainage basin. The St. Francis River, located north of the facility) is identified as an ecologically sensitive water body, and Second Creek (located northeast of the facility) is identified as an extraordinary resource water body, neither of which are located within the same drainage basin as the facility.

5.4.3.3 Specially Designated Areas

The White River National Wildlife Refuge is located within the potentially impacted drainage basin. Surface water drainage from the immediate vicinity of the facility eventually drains into the White River.

5.4.3.4 Recreational Uses of Area

APC&EC Regulation 2 list all surface waters within the drainage pathway from the plant site as primary (watersheds >10 mi.^{2}) and secondary contact recreational areas. Streams are listed as Seasonal Delta Fisheries and/or Perennial Delta Fisheries (watersheds >10 mi.^{2}). No use variations were indicated as of 10-28-02 in *APC&EC Regulation 2*.

6.0 Environmental Site Assessment

Environmental site assessments were conducted in several phases during the site history. The investigations were conducted under CAO authority and associated workplans were approved by ADEQ (or its predecessor ADPC&E).

Associated workplans are listed below:

Hydrogeological Investigation Study, Grubbs Garner and Hoskyn, April 1988
Site Characterization and Drum Disposal Area Delineation Workplan, Woodward-Clyde Consultants, May 1990
Facility Investigation Workplan, EnSafe, January 1993
Phase II Facility Investigation Workplan, EnSafe, June 1994

Interim Response Workplan, Ensafe, April 1995
Risk Assessment Workplan, EnSafe, July 1996
Interim Measures Plan of Action, EnSafe, May 1998
Risk Assessment Workplan Revision 2, EnSafe, October 1998

Seventy-four SWMUs and two areas of concern (AOCs) were identified by EPA in the RFA. Subsequently, eighty SWMUs and three AOCs were identified at CCC in the 1992 FI Preliminary Report. However, subsequent investigations were conducted on a Site basis, incorporating multiple SWMUs and/or AOCs into a Site, rather than investigation by individual SWMU or AOC. According to the available file material, it appears that only 74 SWMUs and two AOCs were carried through to further site investigations. (*Draft Conceptual Site Model*, EPA, 2003)

Table 1[1, 2]
Site Descriptions

Site	Site Name	SWMUs/AOCs Included
1	Wastewater Treatment Ponds	Wastewater Tank 2 (SWMU 63), Flow Equalization Basin (SWMU 64), Aeration Basin (SWMU 65), and Polish Pond (SWMU 68)
2	Former Waste Treatment Ponds	Inactive Pond 1 (SWMU 69), Inactive Pond 2 (SWMU 70), and Inactive Pond 3 (SWMU 71)
3	Stormwater Ditches	Stormwater Drainage System (SWMU 59) and Stormwater Sump (SWMU 60)
4	Rail Spur Loading/Unloading Area	Railroad Spur Loading and Unloading Area (SWMU 74) and Railroad Loading and Unloading Sump (SWMU 3)
5	Drum Vault	Maintenance Services Drum Vault (SWMU 72)
6	Yellow Stained Areas	Yellow Stained Areas (AOC 1)
8	Ditch by Wastewater Treatment Area	Ditch by Wastewater Treatment Area (AOC 3)
9	Former Dinoseb Disposal Ponds	The site is comprised of three suspected abandoned ponds in the area between the dichloroaniline unit and the maintenance services building. These ponds were reportedly shallow, unlined basins used to dispose of off-specification Dinoseb. The ponds are no longer used and have been backfilled. Buildings have also been constructed in the vicinity of the ponds, and some areas have been paved or covered with gravel. Heavy yellow staining is present on the surface soil of unpaved areas.

[1] Environmental and Safety Designs, 1996
[2] Ensafe, 1999
(*Draft Conceptual Site Model*, EPA, 2003)

6.1 Background Conditions

Background soil conditions were evaluated by collecting soil samples from soybean fields adjacent to the facility. Samples were analyzed for VOCs, SVOCs, pesticides and RCRA metals. Three samples were initially collected. All three samples had detectable concentrations of all the types of contaminants. Background sample locations may be impacted by facility operations from air releases as evidenced by the presence of VOCs.

Background conditions of the alluvial aquifer were intended to be evaluated during the investigation with existing monitoring well(s). At least one well (EMW-2) appeared to be located hydraulically upgradient. However, the well was also within close proximity to waste disposal activities that are known to have impacted groundwater quality. Background conditions of the alluvial aquifer may not be represented in any of the previous investigations. The alluvial aquifer is well known to be suitable for most uses including drinking water and irrigation.

6.2 Analytical Parameters

Sample analysis included the following classes of chemical compounds: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, PCB, metals, and water quality indicator parameters. Certain soil samples were evaluated for the purpose of evaluating the potential for contaminants to leach from the soil into groundwater. More than thirty contaminants from all chemical classes were determined to be present in soils and/or groundwater.

6.2.1 Laboratory Analytical Procedures

EPA methods of analysis were used throughout the investigations. ADEQ also requires the use of certified laboratories for all analyses. A summary of the analytical methods used in the investigations are listed below:

Volatile organic compounds - Methods 8240 and/or 8260
Semi-volatile organic compounds – Method 8270
Organochlorine pesticides – Method 8080/608
40 CFR Part 265 Appendix III Metals – Methods 200.7/6010/7000
Ammonia, bicarbonate, calcium, chloride, cyanide, fluoride, iron, magnesium, nitrate, sodium, sulfate, pH, specific conductance

6.2.2 Data Validation

Procedures for data validation were presented in the approved workplans. Additionally, ADEQ reviewed the data submitted and approved the investigation reports.

6.3 Monitoring Wells

Groundwater monitoring wells were installed at the CCC site during various phases of investigation. Six monitoring wells (1MW-1, 1MW-2, 1MW-3, 1MW-4, 1MW-5, and 2MW-2) were installed and screened in the perched groundwater zone. Fifteen upper alluvial groundwater monitoring wells have been installed on site. These include 1MW-6, 1MW-7, 2MW-3, 2MW-4, 2MW-5, 2MW-6, 4MW-1, 4MW-3, 9MW-1, EMW-1, EMW-2, EMW-3, EMW-7, and EPZ-5. Two additional upper alluvial groundwater monitoring wells (OFFMW-2 and OFFMW-4) were installed off site and downgradient of the CCC site. Two lower alluvial groundwater monitoring wells (2MW-7 and 4MW-4) have been installed at the CCC site and two lower alluvial groundwater monitoring wells (OFFMW-1 and OFFMW-3) were installed off site and downgradient of the CCC site. The monitoring well locations are provided in Figures 1 and 2 of the Groundwater Monitoring Report dated September 21, 2001 (Ensafe, 2001). (*Draft Conceptual Site Model*, EPA, 2003)

6.3.1 Installation Procedures

Monitoring well designs and installation procedures are detailed in the *Facility Investigation Workplan*, January 1993. ADPC&E conditionally approved the workplan on June 1, 1993.

6.3.2 Sampling Procedures

Sampling procedures are detailed in the *Facility Investigation Workplan*, January 1993. ADPC&E conditionally approved the workplan on June 1, 1993.

6.4 Groundwater

To date, a groundwater monitoring program has not been established at the site. The most recent groundwater sampling event was conducted in July 2001. The groundwater data indicates that metals, pesticides, semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs) have been detected above either the Federal Maximum Contaminant Levels (MCLs) or the EPA Region 6 Medium Specific Screening Levels (MSSLs) for Tap Water. The primary contaminants of concern, both on and off site, are 1,2-dichloroethane and arsenic. The 1,2-dichloroethane contamination is present in both the perched and alluvial groundwater zones and the contamination has extended at least one mile off site and downgradient of the CCC site. In addition, it appears arsenic contamination has co-mingled with 1,2-dichloroethane contamination, which has resulted in arsenic being relatively mobile, and has migrated along with the dissolved 1,2-dichloroethane contaminant plume. (*Draft Conceptual Site Model*, EPA, 2003)

The maximum detected concentrations in the perched groundwater zone were as follows: 8.8 μg/l of arsenic, 0.087 μg/l of beta-BHC, 0.24 μg/l of Dieldrin, and 100 μg/l of 1,2-dichloroethane. The maximum detected concentrations in upper alluvial groundwater beneath the site are 603 μg/l of arsenic, 810 μg/l of benzene, 170 μg/l of chloroethane, 670 μg/l of 4-chloroaniline, 6,800 μg/l of 1,2-dichlorobenzene, 0.5 μg/l of 1,2-dichlorobenzene, 24,000 μg/l of 1,2-dichloroethane, 170 μg/l of Dinoseb, 2,000 μg/l of ethylbenzene, 480 μg/l of 4-methylphenol, 760,000 μg/l of toluene, 13,000 μg/l of xylenes, and 5 μg/l of vinyl chloride. The maximum detected concentrations detected in upper alluvial groundwater off site include 13.2 μg/l of arsenic and 14,000 μg/l of 1,2-dichloroethane. The maximum detected concentration of 1,2-dichloroethane in lower alluvial groundwater beneath the CCC site was 829 μg/l. The maximum detected concentrations of arsenic and 1,2-dichloroethane in the lower alluvial groundwater off site were 14.3 μg/l and 1,400 μg/l, respectively (Ensafe, 2001). (*Draft Conceptual Site Model*, EPA, 2003).

During the installation of monitoring wells 4MW-1 (near the Unit 1 expansion area) and 4MW-2 (between the Unit 3 expansion area and Unit 4) unusual conditions were encountered. At well 4MW-1 a pocket of gas was encountered in the semi-confined portion of the alluvial aquifer. An explosimeter on the drill rig sounded an alarm indicating the presence of explosive gas. PID reading at the augers indicated a concentration of 144 ppm organic vapors. The gas was sampled with Draager tubes and it was concluded that concentrations were too high to be accurately quantified by that method. Well 4MW-2 was installed approximately 160 feet southwest of well 4MW-1 and no gas was encountered, but soil cores retrieved from the alluvial sands were saturated yellow to orange foamy water.

6.4.1 Site 1 Wastewater Treatment Plant

Groundwater monitoring wells placed around the site indicate mounding caused by an infiltration source. Contaminants detected in perched groundwater suggest the mounding is caused by leakage from the wastewater treatment ponds or has migrated from some other source.

6.4.2 Site 2 Former Wastewater Ponds

Groundwater monitoring wells placed around Site 2 suggest that this area is prone to recharge from precipitation events. Contaminants present in the groundwater suggest that the contaminated soils likely contribute to groundwater contamination through partitioning from solid phase soil into aqueous phase infiltration (intermedia transfer).

6.4.3 Site 4 Railroad Loading Area

Unusual subsurface conditions were encountered at Site 4. During the installation of monitoring wells 4MW-1 (near the Unit 1 expansion area) and 4MW-2 (between the Unit 3 expansion area and Unit 4) unusual conditions were encountered. At well 4MW-1 a pocket of gas was encountered in the semi-confined portion of the alluvial aquifer. An explosimeter on the drill rig sounded an alarm indicating the presence of explosive gas. PID reading at the augers indicated a concentration of 144 ppm organic vapors. The gas was sampled with Draager tubes and it was concluded that concentrations were too high to be accurately quantified by that method. Well 4MW-2 was installed approximately 160 feet southwest of well 4MW-1 and no gas was encountered, but soil cores retrieved from the alluvial sands was saturated yellow to orange foamy water (*Facility Investigation*, EnSafe, June 1998).

6.5 Soils and Sediment

Soils and sediment are discussed together for consistency with data evaluations performed during the investigations. Sediment is discussed separately in the Ecological Risk Assessment section of this report.

6.5.1 Site 1 Wastewater Treatment Ponds

Surface soil, subsurface soil, and sediment samples were collected during Phase I FI activities. Metals, pesticides, SVOCs, and VOCs were detected in both soil and sediment. In the 1999 Risk Assessment (Ensafe, 1999), available surface soil and sediment data were screened against residential MSSLs, and surface/subsurface soil data were screened against industrial MSSLs. Maximum detected concentrations in surface soil that exceeded the residential MSSLs were as follows: 44.6 mg/kg of arsenic, 0.593 mg/kg of Dieldrin, 9.6 mg/kg of Dinoseb, and 7.5 mg/kg of 1,2-dichloroethane. Maximum detected concentrations above industrial MSSLs in surface/subsurface soil included: 44.6 mg/kg of arsenic, 0.593 mg/kg of Dieldrin, and 7.5 mg/kg of 1,2-dichloroethane. Maximum detected concentrations in sediment above residential MSSLs included: 123 mg/kg of arsenic, 82 mg/kg of chromium, and 1,200 mg/kg of 3,4-dichloroaniline. It should be noted that the 3,4-dichloroaniline maximum detected concentration was detected above the 4-chloroaniline MSSL, which was used as a surrogate value because a MSSL for 3,4-dichloroaniline was unavailable. However, 3,4-dichloroaniline was inadvertedly excluded from the 1999 Risk Assessment, and thus, was not quantitatively or qualitatively evaluated. (*Draft Conceptual Site Model*, EPA, 2003)

6.5.2 Site 2 Former Waste Treatment Ponds

During the 1993 field activities for Phase I of the FI, surface soil and subsurface soil samples were collected and analyzed. Metals, pesticides, SVOCs, and VOCs were detected in soil. In the 1999 Risk Assessment (Ensafe, 1999), surface soil data were screened against residential MSSLs, and surface/subsurface soil data were screened against industrial MSSLs. Maximum detected concentrations in surface soil that exceeded the residential MSSLs included: 0.058 mg/kg of Aldrin and 100 mg/kg of Dinoseb. Maximum detected concentrations above industrial MSSLs in soil included: 68.8 mg/kg of arsenic, 161.8 mg/kg of cadmium, 111.7 mg/kg of mercury, 0.5 mg/kg of Aldrin, 0.350 mg/kg of Dieldrin, 170 mg/kg of 1,2-dichloroethane, 0.67 mg/kg of carbon tetrachloride, 13 mg/kg of chloroform, and 380 mg/kg of methylene chloride. (*Draft Conceptual Site Model*, EPA, 2003)

6.5.3 Site 3 Storm water Ditches

During the 1993 field activities for Phase I of the FI, surface soil, subsurface soil, and sediment samples were collected and analyzed. Additional sampling was conducted in Phase II and Phase III of the FI activities. Metals, pesticides, SVOCs, and VOCs were detected in sediment, and Dinoseb was the only contaminant detected in soil. In the 1999 Risk Assessment (Ensafe, 1999), soil data were screened against industrial MSSLs, and sediment data were screened against residential MSSLs. Maximum detected concentrations above industrial MSSLs in soil included 13,000 mg/kg of Dinoseb. Maximum detected concentrations in sediment above residential MSSLs included: 222 mg/kg of arsenic, 0.354 mg/kg of Aldrin, 3.4 mg/kg of Dieldrin, 1.6 mg/kg of Toxaphene, and 5.3 mg/kg of pentachlorophenol. (*Draft Conceptual Site Model*, EPA, 2003)

6.5.4 Site 4 Rail Spur Loading/Unloading Area

During the 1993 field activities for Phase I of the FI, surface soil and subsurface soil samples were collected and analyzed. Pesticides and VOCs were detected in soil consistently at elevated concentrations. In the 1999 Risk Assessment (Ensafe, 1999), available surface soil data were screened against residential MSSLs and surface/subsurface soil data were screened against industrial MSSLs. Maximum detected concentrations in surface soil that exceeded the residential MSSLs were as follows: 0.455 mg/kg of Dieldrin and 840 mg/kg of Dinoseb. Maximum detected concentrations above industrial MSSLs in subsurface soil included: 15.5 mg/kg of arsenic, 0.63 mg/kg of Dieldrin, 12,000 mg/kg of 3,4-dichloroaniline, 1,100 mg/kg of Dinoseb, and 0.82 mg/kg of 1,2-dichloroethane. (*Draft Conceptual Site Model*, EPA, 2003)

During the installation of monitoring wells 4MW-1 (near the Unit 1 expansion area) and 4MW-2 (between the Unit 3 expansion area and Unit 4) unusual conditions were encountered. At well 4MW-1 a pocket of gas was encountered in the semi-confined portion of the alluvial aquifer. An explosimeter on the drill rig sounded an alarm indicating the presence of explosive gas. PID reading at the augers indicated a concentration of 144 ppm organic vapors. The gas was sampled with Draager tubes and it was concluded that concentrations were too high to be accurately quantified by that method. Well 4MW-2 was installed approximately 160 feet southwest of well 4MW-1 and no gas was encountered, but soil cores retrieved from the alluvial sands was saturated yellow to orange foamy water.

6.5.5 Site 5 Maintenance Services Drum Vault

This site is comprised of SWMU 72, which is a concrete drum vault with a sub-floor of gravel, sand, and possibly cement located under the Maintenance Services Building. In 1993, subsurface soil samples were collected beneath the drum vault as part of the Phase I FI investigation and Dinoseb was detected beneath the vault, which CCC attributed to residual contamination from Site 9. No further action was recommended in the FI Report; however, ADPCE did not concur and required additional investigation. Subsequent to developing media-specific cleanup criteria, CCC intended to conduct additional sampling as part of a CMS. (*Draft Conceptual Site Model*, EPA, 2003)

In the 1999 Risk Assessment (Ensafe, 1999), available soil (including surface and subsurface soil) data were screened against industrial MSSLs. Maximum detected concentrations above industrial MSSLs in subsurface soil included: 9.7 mg/kg of arsenic and 170 mg/kg of Dinoseb. (*Draft Conceptual Site Model*, EPA, 2003)

6.5.6 Site 6 Yellow Stained Areas (Area of Concern 1)

Surface soil and subsurface soil samples were collected during Phase I FI activities. Metals, pesticides, SVOCs, and VOCs were detected in both soil and sediment. In the 1999 Risk Assessment (Ensafe, 1999), available surface soil data were screened against residential MSSLs. Maximum detected concentrations in surface soil that exceeded the residential MSSLs were as follows: 0.24 mg/kg of Aldrin, 0.078 mg/kg of Dieldrin, 340 mg/kg of Methoxychlor, 14 mg/kg of Toxaphene, and 160 mg/kg of Dinoseb. (*Draft Conceptual Site Model*, EPA, 2003)

6.5.7 Site 8 Ditch by Wastewater Treatment Area (Area of Concern 3)

Surface soil samples were collected during Phase I FI activities. Metals and Dieldrin were detected in surface soil. In the 1999 Risk Assessment (Ensafe, 1999), available surface soil data were screened against residential MSSLs. Maximum detected concentrations of 6.3 mg/kg of arsenic were above residential MSSLs. (*Draft Conceptual Site Model*, EPA, 2003)

6.5.8 Site 9 Former Dinoseb Disposal Ponds

During the 1993 field activities for Phase I of the FI, surface soil and subsurface soil samples were collected. Metals, pesticides, SVOCs, and VOCs were detected in soil. In the 1999 Risk Assessment (Ensafe, 1999), available surface soil data were screened against residential MSSLs, and surface/subsurface soil data were screened against industrial MSSLs. Maximum detected concentrations in surface soil that exceeded the residential MSSLs were as follows: 0.15 mg/kg of Heptachlor, 450 mg/kg of 3,4-dichloroaniline, 29,000 mg/kg of Dinoseb, 4,000 mg/kg of Propanil, and 3.5 mg/kg of arsenic. Maximum detected concentrations above industrial MSSLs in subsurface soil included: 7.3 mg/kg of arsenic, 29,000 mg/kg of Dinoseb, 450 mg/kg of 3,4-dichloroaniline, 4,000 mg/kg of Propanil, and 0.73 mg/kg of 1,2-dichloroethane. (*Draft Conceptual Site Model*, EPA, 2003)

Leaching tests performed on samples taken from Site 9 suggest a high potential for intermedia transfer.

6.5.9 Dichloroethane Source Area

Based on the concentration gradient of the plume determined after the completion of the Phase II investigation, it was concluded that the likely source area is near the production units on the northeast side of the plant. During interviews with employees, it was learned that there was formerly a tile wastewater discharge pipe that ran from Unit 5 to the wastewater treatment ponds, crossing the path of the suspected source area. The pipe was known to frequently leak. The area was investigated by sampling soils on 75 feet by 75 feet grid.

Analysis from the source area soil samples indicates two potential sources. The most heavily impacted area is southwest of Unit 4 and northeast of monitoring well EMW-7 (which is also the most heavily contaminated well with 1,2-dichloroethane at 84,000 ppb). The second, and less contaminated, source area appears to be around the southeastern side of Unit 5.

As the pipe was being decommissioned, an unknown quantity of a liquid chemical was observed in the pipe and trench (*Facility Investigation*, EnSafe, June 1998).

6.6 Surface Water

Surface water was managed under the facility's NPDES permit and was therefore not evaluated during the investigations or risk assessment done under ADEQ Hazardous Waste Division. The HWD collected surface water data since abandonment and this information is presented in attachments. Low levels of volatile and semi-volatile organic compounds are typically present in stormwater samples. Since stormwater is controlled, complete exposure pathways are unlikely.

6.7 Air

Ambient air monitoring was conducted during Phase III of the investigation. Five stations at the site were monitored for six days. Each station was sampled with an FID for approximately two minutes. Concentrations ranged from non-detect to 2.1 ppm. Each of the five stations had at least one detection event. The FID device does not identify specific compounds and therefore the data is of no value for risk evaluation. The facility air permit allows discharge of compounds that are detectable by the FID.

Indoor air pathways from soils or groundwater were not evaluated in the Risk Assessment.

During the installation of monitoring wells 4MW-1 (near the Unit 1 expansion area) and 4MW-2 (between the Unit 3 expansion area and Unit 4) unusual conditions were encountered. At well 4MW-1 a pocket of gas was encountered in the semi-confined portion of the alluvial aquifer. An explosimeter on the drill rig sounded an alarm indicating the presence of explosive gas. PID reading at the augers indicated a concentration of 144 ppm organic vapors. The gas was sampled with Draager tubes and it was concluded that concentrations were too high to be accurately quantified by that method. Well 4MW-2 was installed approximately 160 feet southwest of well 4MW-1 and no gas was encountered, but soil cores retrieved from the alluvial sands was saturated yellow to orange foamy water.

6.8 Environmental Site Assessment Conclusions

ADEQ required Cedar to conduct an investigation of certain solid waste management units (SWMUs) due to the presence of visible contamination, non-compliance with applicable regulations for hazardous waste management, and related problems with stormwater runoff. Background conditions were also evaluated during the investigation.

Nine SWMUs and other areas of concern (AOCs) were included in the investigation. Extensive investigations of surficial and subsurface soils were done at the direction of ADEQ. Sample analysis included the following classes of chemical compounds: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), chlorinated pesticides, and metals. More than thirty contaminants from all chemical classes were determined to be present in soils. Waste materials were also determined to be present within certain SWMUs. All nine of the SWMUs and other areas of concern were determined to have contaminants present in concentrations greater than background and at concentrations that may continue to contribute to groundwater contamination. The investigation concluded significant impacts to surficial soils, surface water, and subsurface soils resulted from facility operations.

Surface soils were visibly stained yellow throughout most of the site history. The yellow color is associated with contamination from the herbicide Dinoseb. Subsurface soils at several of the SWMUs contain contaminants in concentrations that may be considered hazardous waste. Soil cores and chemical analysis indicate that technical grade products were disposed in open pits. ADEQ did not issue any permits for land disposal of solid or hazardous wastes at the facility over the entire site history.

ADEQ required Cedar to conduct a groundwater quality assessment to evaluate the nature and extent of contaminants released from soils to the groundwater. Various pesticides, metals, semi-volatile organic compounds, and volatile organic compounds were determined to have been be released from contaminated soils into perched groundwater and the alluvial aquifer.

The groundwater quality assessment showed that the groundwater contaminant plume is not stable and continues to grow or lengthen down gradient of the site. Contaminant concentrations increased five orders of magnitude in off-site well OFFMW-2over the course of the groundwater investigation. This indicates that there are both continuing releases from contaminated soils into the groundwater and/or new releases from nonspecific sources causing further expansion of the plume. Approximately 200 drums of unknown waste materials are reported to be disposed in the foundation of a building representing a high risk for new or continuing releases into both soils and groundwater.

More than 20 contaminants have been detected in the groundwater. Groundwater in several locations may considered TC hazardous waste (D028) due to the presence of 1,2-dichloroethane (DCA) exceeding the 0.5 mg/L regulatory criteria. Contaminated media containing hazardous constituents in excess of toxicity characteristic (TC) may be considered a hazardous waste for treatment storage or disposal. EPA has determined that DCA is a probable human carcinogen. DCA has an MCL of 0.005 mg/L published for drinking water supplies. DCA has been detected in on-site groundwater at concentrations up to 84 mg/L.

Contaminated groundwater exceeding both the toxicity characteristic and MCL extends through a portion of the alluvial aquifer more than 4000 feet off-site. DCA was reported to be present at 14 mg/L in off-site well OFFMW-2 during a July 2001 sampling event. Earlier sampling events showed DCA present in concentrations orders of magnitude less than the July 2001 sampling event, indicating significant plume movement. The alluvial aquifer is known to be used for drinking water and currently meets recognized aquifer classifications as a drinking water aquifer. Groundwater is currently used for irrigation in the immediate vicinity of the site. At least two irrigation wells are known to be contaminated with hazardous substances associated with the site.

7.0 Human Health Risk Assessment

For the human health risk assessment (HHRA), the facility was evaluated based on the eight sites (Sites 1,2,3,4,5,6,8, and 9) that were defined during the RCRA Facility Investigation. The sites were grouped based on the exposure setting and the chemicals detected. Soil and sediment data were evaluated by site, while groundwater was evaluated separately as either perched groundwater or the alluvial aquifer groundwater. Framework for the HHRA was based upon the *Risk Assessment Workplan* (Ensafe 1998).

The list of chemicals detected in site media selected for inclusion in the quantitative HHRA was obtained by: (1) comparison of the site-related data to risk-based screening levels and (2) comparison to site related background concentrations. Risk-based screening values were from *USEPA Region 6 Human Health Medium-Specific Screening Levels* effective at the time of the evaluation. Compounds exceeding screening criteria are considered constituents of potential concern (COPC) and were carried through for further evaluated in the HHRA. COPCs are listed below.

Constituents of Potential Concern

Site	Surface Soil	Surface and Subsurface Soil	Sediment
1	arsenic, Dieldrin, 1,2-dichloroethane	arsenic, Dieldrin, 1,2-dichloroethane	arsenic, chromium
2	Aldrin, Dinoseb	Arsenic, cadmium, mercury, Aldrin, Dieldrin, 1,2-dichloroethane, carbon tetrachloride, chloroform, methylene chloride	NA
3	NA	Dinoseb	arsenic, Aldrin, Dieldrin, Toxaphene, pentachlorophenol
4	Dieldrin, Dinoseb	arsenic, Dieldrin, Dinoseb 3,4-dichloroaniline, 1,2-dichloroethane	NA
5	NA	arsenic, Dinoseb	NA
6	arsenic, Aldrin, Dieldrin, Methoxychlor, Toxaphene, Dinoseb	NA	NA
8	None	NA	NA
9	Heptachlor, Dinoseb, 3,4-dichloroaniline, Propanil	arsenic, Dinoseb, 3,4-dichloroaniline, Propanil, 1,2-dichloroethane	NA

Note: NA=no samples

COPCs identified for perched groundwater include: arsenic, lead, 4,4'-DDT, alpha-BHC, 1,4-dichlorobenzene, 2,6-dinitrotoluene, 4-chloroaniline, bis(2-chloroethyl)ether, 1,2-dichloroethane, 4-methyl-2-pentanone, acetone, benzene, chloroform, methylene chloride, and trichloroethene.

COPCs identified for the alluvial aquifer groundwater include: 1,1,2-trichloroethane, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloropropane, benzene, bromodichloromethane, chlorobenzene, chloroform, dibromochloromethane, methylene chloride, and vinyl acetate.

Risk was further evaluated considering current and future land uses for the following receptors: site workers, construction workers, trespassers, and off-site agriculture workers. Exposure pathways included one or more of the following: inhalation of gaseous contaminants released from soil, inhalation of chemicals entrained in fugitive dust, inhalation of gaseous contaminants released from groundwater, incidental ingestion, and dermal contact.

A contaminant was selected as a chemical of concern (COC) if its cancer risk exceeded 1E-6 or had a hazard quotient (HQ) greater than 1 for reasonable maximum exposures (RME). Chemicals of concern are listed on the following table.

Chemicals of Concern

Site	Surface Soil	Subsurface Soil	Sediment
1	None	None	arsenic
2	None	1,2-dichloroethane	N/A
3	N/A	Dinoseb	None
4	Dinoseb	3,4-dichloroaniline, Dinoseb	N/A
5	N/A	Dinoseb	N/A
6	None	N/A	N/A
9	Dinoseb, Propanil	3,4-dichloroaniline, Dinoseb, Propanil	N/A
Perched Groundwater	4-chloroaniline, 1,2-dichloroethane, methylene chloride		
Alluvial groundwater	benzene, chloroform, methylene chloride, 1,2-dichloroethane, 1,2-dichloropropane, and chlorobenzene		

Note: N/A=not applicable

Where reasonable maximum exposure estimates of risk indicated a significant threat would be posed, central tendency (CT) analysis was performed. A significant threat was defined as a cancer risk greater than 1E-4 or HQ greater than 1.

It was concluded that the alluvial groundwater risks based on the RME and CT exposure assumptions for the offsite agricultural worker represent the most substantial carcinogenic risks to human receptors contacting contaminated media associated with the site. Non-carcinogenic risk based on RME for all receptors are substantially high based primarily on construction worker exposures to Dinoseb in surface and subsurface soil at Sites 3, 4, and 9.(*Risk Assessment*, October 1999)

Noncarcinogenic risk estimated in the RA for the offsite agricultural worker exposed to volatile organic compounds released from the alluvial groundwater during irrigation CT exposure HQ were: 1,2-dichloroethane (1511), chlorobenzene (4), 1,2-dichloropropane (6), and benzene(8).

Carcinogenic risk estimated in the RA for the offsite agricultural worker exposed to volatile organic compounds released from the alluvial groundwater during irrigation were: 1,2-dichloroethane (1E-02), methylene chloride (5E-4) and benzene (2E-4).

The 1999 Risk Assessment quantitatively evaluated inhalation of volatiles and dust, incidental ingestion and dermal contact with surface soil exposure pathways for the current/future on-site worker population. The following table provides the total risk and hazard index across all media and all exposure routes for on-site worker by Site (Ensafe, 1999). Refer to the 1999 Risk

Assessment for specific details on methodology Ensafe used to evaluate risk for current/future on-site workers. . (*Draft Conceptual Site Model*, EPA, 2003)

Summary of Current/Future On-site Worker Cancer Risks and Hazardous Indices Reasonable Maximum Exposure		
Site	**Total Risk Across All Media and All Exposure Routes**	**Total Hazard Index Across All Media and All Exposure Routes**
1	1E-04	<1
2	3E-06	<1
4	8.3E-06	<1
6	5E-06	<1
9	2E-05	254

The 1999 Risk Assessment quantitatively evaluated inhalation of volatiles and dust, incidental ingestion, and dermal contact with surface/subsurface soil, incidental ingestion and dermal contact with sediment, and incidental ingestion and dermal contact with perched groundwater exposure pathways for the future on-site construction worker population. The following table provides the total risk and hazard index across all media and all exposure routes for on-site construction worker by Site (Ensafe, 1999). Refer to the 1999 Risk Assessment for specific details on methodology Ensafe used to evaluate risk for future on-site construction workers. . (*Draft Conceptual Site Model*, EPA, 2003)

Summary of Future Construction Worker Cancer Risks and Hazardous Indices Reasonable Maximum Exposure		
Site	**Total Risk Across All Media and All Exposure Routes**	**Total Hazard Index Across All Media and All Exposure Routes**
1	5.4E-05	21
2	6E-05	9
3	4.5E-07	40
4	3E-07	13
5	2.9E-07	<1
6	7.2E-08	<1
9	2E-07	91

The 1999 Risk Assessment quantitatively evaluated inhalation of volatiles and dust, incidental ingestion and dermal contact with surface soil, incidental ingestion and dermal contact with sediment exposure pathway for the future site trespasser population. The following table provides the total risk and hazard index across all media and all exposure routes for site trespasser by Site (Ensafe, 1999). Refer to the 1999 Risk Assessment for specific details on methodology Ensafe used to evaluate risk for future trespassers. . (*Draft Conceptual Site Model*, EPA, 2003)

Summary of Future Trespasser Cancer Risks and Hazardous Indices Reasonable Maximum Exposure		
Site	**Total Risk Across All Media and All Exposure Routes**	**Total Hazard Index Across All Media and All Exposure Routes**
1	7E-05	<1
2	4E-07	<1
3	1.6E-05	<1
4	3E-06	<1
6	6E-07	<1
9	3E-06	82

ADEQ and representatives of CCC met on March 1, 2001, to discuss risk issues and it was agreed that additional investigations were necessary to refine the RA. Samples were collected from eight irrigation wells in July 2001. Two offsite irrigation wells (in addition to offsite facility monitoring wells) were found to be contaminated with 1,2-dichloroethane. The impacted irrigation wells were identified as AGI-1 (located approximately 3500 feet south of the site) and the BHA-1 located (located approximately 240 feet southeast of the site). Risk was re-evaluated based upon actual data from the irrigation wells. Noncarcinogenic risk to the offsite agricultural worker exposed to contaminants emanating from both AGI-1 and BHA-1 are less than HQ 1. Carcinogenic risks are 7E-06 for the worker exposed to groundwater from AGI-1 and 5E-06 or the worker exposed to groundwater from BHA-1. This reevaluation of risk was presented in the *Risk Assessment Addendum*, January 2002.

8.0 Ecological Risk Assessment

Arsenic, Aldrin, Dieldrin, 4,4'-dichlorodiphenyldichloroethylene (4,4'-DDE), 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD), 4,4'-dichlorodiphenyltrichloroethane (4,4'-DDT), Endrin, gamma-BHC, Methoxychlor, and Toxaphene were detected in sediment at Area I above the EPA Region 4 sediment screening values. Two potential receptors (tadpoles and piscivorus birds) were identified in the 1999 Risk Assessment. Tadpoles in the ditches may potentially be exposed to contaminated sediment identified in the ditches. Because of the nature of contamination in sediment, bioaccumulation is possible. In addition, piscivorus birds may also ingest tadpoles with elevated levels of pesticides. However, the 1999 Risk Assessment indicates the potential risk in Area I was considered acceptable because the ditches are used as an integral component of the facility's wastewater treatment system. Due to the function of these ditches, standing water is frequently drained and, thus, any emerging aquatic habitat was considered opportunistic (Ensafe, 1999).

No potentially complete ecological exposure pathways for Area II were identified in the 1999 Risk Assessment (Ensafe, 1999).

In Area III, an ecological potential pathway identified in the 1999 Risk Assessment included receptors exposed to contaminated groundwater during irrigation activities. However, ecological risks were not evaluated since no data was available from the irrigation wells at the time the 1999 Risk Assessment was conducted. The risk assessment indicated that only small mammals and birds species are present in Area III. The risk assessment indicated that during hot summer months when irrigation is frequent, wildlife species are likely dormant during the heat of the day and seek refuge in wooded areas. Thus, exposure to contaminated groundwater during irrigation events was not anticipated to be significant for potential ecological receptors (Ensafe, 1999).